



"We bring people to space — We bring space to people"

X-33 liquid hydrogen fuel tank ready for tests here

by Kelly McFalls

A major component of the X-33 advanced technology demonstrator — one of its twin composite liquid hydrogen fuel tanks — soon will undergo a series of pressure and stress tests at Marshall.

Tests are to begin this week on the first of two 4,600-pound graphite epoxy tanks, each designed to carry approximately 29,000 gallons of rocket fuel — liquid hydrogen — at -423 degrees Fahrenheit. The twin hydrogen tanks form the flanks of the X-33 vehicle and comprise roughly half its airframe.

The X-33 is being developed in a partnership between NASA and Lockheed Martin Skunk Works in Palmdale, Calif. The vehicle is a half-scale, sub-orbital technology demonstrator of a proposed future reusable launch vehicle Lockheed Martin calls "VentureStar." Managed for NASA by the Marshall Center, the X-33 program is designed to demonstrate advanced technologies that will dramatically increase launch vehicle reliability and safety, while lowering the cost of putting a pound of payload into space from \$10,000 to \$1,000.

The first 29-foot tank has been placed into a structural test facility in the West Test Area at the Marshall Center where it will receive cryogenic, or very low temperature, propellant and



File photo

A major component of the X-33 advanced technology demonstrator — one of its twin composite liquid hydrogen fuel tanks — is ready to undergo a series of pressure and stress tests at the Marshall Center. Mounted into a test stand, the tank will receive cryogenic, or very low temperature, structural loads and pressure cycles over the next six-to-eight weeks of testing.

structural loads and pressure cycles over a four to six-week period. External loads also will be applied to the tank to simulate

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Six projects to study breakthrough propulsion physics

A proposal from two Marshall researchers is among six recently selected by Glenn Research Center in Cleveland for experiments and theoretical work in breakthrough propulsion physics — research that may ultimately lead to methods of practical interstellar travel.

The Glenn Breakthrough Propulsion Physics Program is part of an effort to provide scientific advancements necessary for future propulsion technology. It is funded by the Advanced Space Transportation Program, managed by the Marshall Center, and the Advanced Concepts Program of the NASA Office of Space Science in Washington, D.C.

The distances between stars is so great that with existing propulsion technology, a probe would travel tens of thousands of years before reaching our nearest neigh-

boring star. Even with the most ambitious new propulsion technology based on known physics, it would still be extremely difficult for a probe to reach that far within 50 years.

To overcome these limitations to practical interstellar space travel, new propulsion physics is being sought by the Breakthrough Propulsion Physics program. These six research selections are an early step in this process.

"Intriguing developments have appeared in recent scientific literature that can serve as starting points for this kind of research," says Marc Millis, project manager for the program at Glenn. The Breakthrough Propulsion Program is the beginning of NASA's effort to systematically assess these findings and theories. "At this stage of research, success is

defined as learning more about these developments rather than achieving breakthroughs," Millis adds.

The proposals were selected after a two-stage peer review process. In the first stage, 50 specialists from academia, government and industry scored the 60 proposals received. In the second stage, government reviewers selected a variety of approaches from the top-ranking proposals.

The proposers will negotiate for grants, contracts or cooperative agreements worth a total program value of \$430,000.

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"Cut Out Accidents, Get Safe"
— Safety slogan submitted by
Vickie Bevels, HEI

First Space Station experiment facility arrives at Marshall

by Tracy McMahan

The Microgravity Science Glovebox Ground Unit — delivered to the Marshall Center Aug. 30 — will be used at Marshall's Microgravity Development Laboratory to test experiment hardware before it is installed in the flight glovebox aboard the International Space Station U.S. Laboratory Module, Destiny.

The Space Station glovebox will provide a sealed work area for experiments conducted in the unique, near-weightless, microgravity environment aboard the International Space Station. The Microgravity Science Glovebox Flight Unit is scheduled to be installed in Destiny in 2001.

"We are very excited about receiving the first Space Station facility," said Bob Johnson, a manager at Marshall's Microgravity Development Laboratory. "Investigators will be able to bring in their experiment hardware, install it in the glovebox in our laboratory and make sure their experiment will work inside the glovebox aboard the Space Station."

Marshall's new Microgravity Development Laboratory assists science researchers in preparing experiments, from conception in the lab to implementation in space. Scientists are working with Marshall engineers at the laboratory to prepare hardware for the Space Station, now being assembled in orbit. The Space Station will provide the only permanent laboratory free of the effects of gravity where long-term scientific research can be conducted.

The glovebox aboard the Space Station will support experiments in all five microgravity fields: biotechnology, combustion science, fluid physics, fundamental physics and materials science. Gloveboxes are especially useful when chemicals, fluids and burning or molten samples need to be contained.

Like similar gloveboxes flown on the Space Shuttle, crewmembers insert their hands in gloves attached to the facility



File photo

Andreas Schuette of DaimlerChrysler Aerospace, left; Mary Etta Wright, a test engineer in the Microgravity Development Laboratory, center; and Wolfgang Froeihoer of the European Space Agency are preparing to check out the microgravity science glovebox unit.

doors. Using the gloves, they can manipulate samples contained inside the sealed experiment chamber.

As the experiment is conducted in space, the crew can see inside the glovebox. A video display also shows glovebox experiments, and the crew can scrutinize samples with a microscope attached to the inside of the glovebox. Video is sent from the Space Station to scientists on Earth so that they can observe their experiments as they take place in orbit.

The Microgravity Science Glovebox Flight Unit is twice as large as the glovebox flown on the Space Shuttle and will occupy a double floor-to-ceiling rack inside the bus-size Destiny module. This more sophisticated glovebox holds larger experiments, and investigators can control their experiments from the ground. The glovebox also has a new video system and a coldplate that can be used to cool hot furnaces and other samples. It supplies vacuum, venting and gaseous nitrogen, and increased power, to experiments.

The European Space Agency delivered the Microgravity Science Glovebox Ground Unit to the Marshall Center and is responsible for providing the Microgravity Science Flight Unit for the Space Station. They also will provide an additional Microgravity Science Glovebox Engineering Unit for ground control experiments at Marshall's Microgravity Development Laboratory. This twin of the actual flight hardware will aid researchers before and during actual missions to the Space Station.

Another Microgravity Science Glovebox Training Unit will be delivered to NASA's Johnson Space Center in Texas. In exchange for developing four Microgravity Science Gloveboxes, the European Space Agency will have use of experiment facilities inside Destiny until their Space Station laboratory — the Columbus Orbital Facility — is attached to the Space Station.

The writer, a contractor employed by ASRI, supports the Media Relations Department.

Superfund cleanup activities

Former Industrial Wastewater Treatment Facility meets EPA standards

The Former Industrial Wastewater Treatment Facility at Marshall has been deemed free of risk to human health or the environment by the Environmental Protection Agency and the Alabama Department of Environmental Management.

In 1994, Marshall Center was placed on the National Priorities List of sites eligible for cleanup under Superfund, an environmental program managed by the Environmental Protection Agency to clean up hazardous waste sites throughout the United States.

The Former Industrial Wastewater Treatment Facility is one of 11 groups of operable units identified as Superfund Sites at Marshall. The facility was constructed in the 1960s to treat wastewater from the industrial sewer. Additional treatment operations were built in the late 1960s or early 1970s to treat wastewater containing metals from Bldg. 4760 plating shop. The facility was operational from 1969-1989. Part of the facility was closed in 1990 under the environmental program Resource Conservation and Recovery Act. When Marshall was listed as a Superfund site in 1994, the facility was investigated under Superfund or Comprehensive Environmental Response, Compensation and Liability Act.

During the facilities Superfund investigation, the Marshall Center examined soil, subsoil and groundwater. These samples were tested in laboratories to see if they contained any hazardous contaminants. Results of the sample tests and risk analysis showed the facility to be no risk to human health or the environment.

Sampling and investigation continues across Marshall. Environmental scientists have collected samples of soil, sediments, surface water, groundwater and fish tissue. Results have determined a need to restore the West Test Area Deluge Pond, East Test Area Liquid Waste Disposal Pond and the soils at Bldg. 4760.

The groundwater is being investigated through several studies. Marshall has been studying Center groundwater to learn its course, the rate at which it flows, where it



File photo

Aerial view of the former Industrial Wastewater Treatment Facility at Marshall.

leads and ultimately, the type and amount of contamination — if any — that needs to be removed.

Fluorescent dye was injected at various well sites and sinking streams within Marshall Center. A series of automated groundwater collection samplers placed around the Center determined the direction, velocity and distribution of groundwater.

Aerial thermography was also used to investigate groundwater. Using an aerial thermographical scan of Marshall, groundwater springs were identified from temperature differences between groundwater and surface water. The groundwater springs are more direct contact points with the water under the ground making them good sampling and dye recovery points for the groundwater. Also being studied is the relationship between the Tennessee River and the groundwater, contaminant relationships and natural decay of contaminants.

To date, studies show Marshall Center has seven contaminated underground bodies of water called “plumes” that flow through the soil and bedrock. Environmental tests of those plumes are scheduled for completion by the end of 1999. Tests of various remediation technologies to

remedy ground conditions are under way.

“We’ve made significant progress in a rather short time,” said Dr. Rebecca McCaleb, director of Marshall’s Environmental Engineering and Management Office. “Our investigations to date indicate that the surface conditions at Marshall pose no threat to public health or the environment.”

Efforts to provide information on the Superfund investigations include a “Lunch and Learn” session in Morris Auditorium Sept. 10 from 11:30 a.m.-noon to discuss the Superfund investigation of the Former Industrial Wastewater Treatment Facility, Operable Unit 9.

On Sept. 13, a meeting for the general public will be held from 6:30-8:30 p.m. at the Huntsville/Madison County Public Library, 915 Monroe St., in Huntsville.

A poster display explaining the Superfund activities will be set up outside the Bldg. 4203 cafeteria from 10:30 a.m.-12:30 p.m. on Sept. 13.

Marshall Environmental Engineering and Management Office personnel will be available at all meetings to answer questions. Marshall personnel and contractors are invited to attend all meetings.

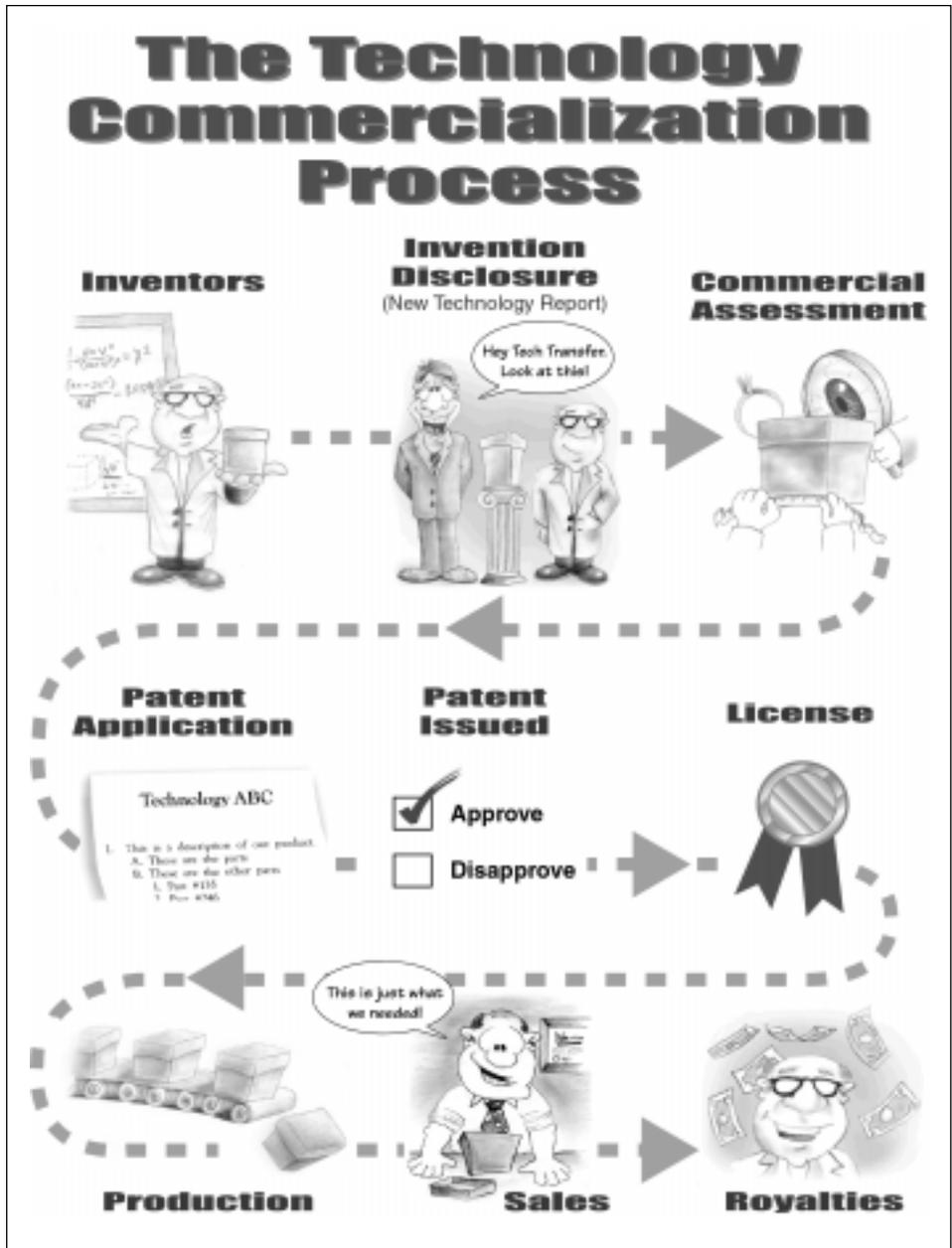
Reporting new technologies reaps monetary rewards

Reporting of new technologies resulting from innovations developed by NASA employees and innovations developed under NASA funding agreements is essential to achieving NASA's goal to commercialize aeronautics and space technological advances. It can also earn innovators quite a bit of money!

"New technology reporting is a requirement for civil service employees, as well as for companies and universities awarded NASA research and development contracts, cooperative agreements, grants or other funded arrangements where there is a potential for inventions and technology innovations," said Susan Whitfield, Marshall's new technology representative. "Beyond the contributions that innovators are able to make in adding to the Center's store of valuable technology for application in public and private endeavors are the potentially substantial personal rewards they can receive."

Monetary rewards are possible in a number of ways: \$150 per author for technologies selected for publication in NASA Tech Briefs Magazine; \$500 for sole authors of software innovations, or \$250 each for multiple authors; and \$500 for sole innovators of technologies selected for patent application filing, or \$250 each for multiple innovators. In addition to these "automatic" type awards, there is a potential for further special board action awards from NASA Headquarters. These awards are based on evidenced commercial potential of a technology and can range from \$1,000 - \$10,000. "And last, but certainly not least, are the royalties that go back to the innovator from technologies that are patented and licensed. These royalty payments can reach up to \$150,000 a year for each invention per innovator," Whitfield said.

Additional benefits from the new technology reporting process include commercialization assessment and marketing analysis and assistance for selected technologies, compliance with U.S. Export Control regulations, proper



coordination by the Technology Transfer Department with Marshall's patent counsel, and to capture metrics for assessment of NASA's technology transfer program.

"Part of our initiative to revise Marshall's new technology reporting process, which feeds our commercialization effort, has been to make the mechanics of the reporting process as painless as possible," Whitfield said. Marshall also will serve as the pilot center for launching the Electronic New Technology Reporting Program that will make reporting innovations even faster and easier. Kickoff for

the new program is Oct. 5.

"Marshall's strength is its people and the incredible capabilities they have," Whitfield said. "We want to tap into that strength and use it to maximize the benefits for the Center as well as the innovators. If we can just get the new technology report, we'll take it from there."

To learn more about the process and to access the required forms, innovators should call Whitfield at 544-1933, or visit the Web site at:

<http://www.nasasolutions.com/innovate.html>

New NASA ocean radar watches for breakup of giant iceberg

A NASA satellite instrument is keeping an eye on an iceberg the size of Rhode Island, the first time this space technology has been used to track a potential threat to international shipping.

NASA's new orbiting SeaWinds radar instrument, flying aboard the QuikScat satellite, will monitor Iceberg B10A, which snapped off Antarctica seven years ago and has since drifted into a shipping lane.

Iceberg B10A, which measures about 24 miles by 48 miles, was spotted by the instrument during its first pass over Antarctica, demonstrating SeaWinds' all-weather and day-night observational capabilities.

The massive iceberg extends about 300 feet above water and may reach as deep as 1,000 feet below the ocean's surface. It is breaking up into smaller pieces that could pose a threat to commercial, cruise and fishing ships if the pieces are blown back into the shipping lane by high winds.

"Although the iceberg isn't posing a threat to ships in the area right now, pieces of B10A could be blown back into the shipping lane and become a danger to ships using the Antarctic's Drake Passage," said Dr. David Long, a member of the SeaWinds

science team from Utah's Brigham Young University in Provo.

Long said that the SeaWinds instrument will be able to help scientists at the National Ice Center, Suitland, Md., track pieces of the iceberg down to about 2.5 miles in size.

B10A, which took hundreds of thousands of years to form, broke off the end of the Thwaites glacier of Antarctica in 1992, and has been drifting in the ocean ever since, driven by ocean currents and wind. In 1995, the iceberg broke in half, but was being tracked on a regular basis. Although conventional methods of tracking sea-surface ice — using ships' radar, shipping reports, optical images from satellites and microwave sensor data — are usually sufficient for tracking large pieces of ice, icebergs can sometimes disappear in the poor visibility of dark, cloudy Antarctic winters.

"That happened earlier this year, when we lost track of B10A's exact whereabouts," Long said. "Even though a ship was dispatched to the iceberg's last known position, we were unable to find it until we started receiving data from the SeaWinds instrument in July."

For more information, visit the Web at:
<http://photojournal.jpl.nasa.gov>

Customer comments lead to bigger taxis

Comments received by the Logistics Services Department from its customer survey feedback system reveal many of its customers are dissatisfied with the taxi vehicle legroom and with amount of time they wait to be picked up.

As a result of the comments, Logistics Services is changing the taxi fleet from the Oldsmobile vehicles to Chrysler vehicles, which have more legroom. Several Chrysler vehicles were used as taxis on a trial basis and received favorable customer responses.

The department would like to provide a taxi service that could ensure all passengers are picked up within five minutes. But budgetary constraints imposed during the award of the last contract required an increase in the response time from five minutes to a maximum of 20 minutes. In most instances, taxis are able to meet or exceed pickup times of five minutes.

During special events, the taxi driver pool also is used to operate the special buses and vans, which results in a response time often exceeding five minutes but never greater than 20.

Combined Federal Campaign bus tours to begin Sept. 28

The Marshall Center's 1999 Combined Federal Campaign (CFC) bus tours to recipient agencies will begin Sept 28. The CFC kickoff is Oct. 4. Complete CFC information can be found on the Web at:
<http://inside/msfc.nasa.gov/CFC99/index.html>

Marshall employees, including contractors, can tour Christmas Charities, Habitat for Humanity, the Association for Retarded Citizens (Opportunity Center) of Madison County, American Red Cross, the Volunteer Center, Harris Home for Children, Children's Hospital and Chi-Ho, The Children's Home.

Two buses (A and B) will leave Marshall Sept. 28 and 30; and Oct. 5, 6 and 7 from Bldg. 4610 at 8:15 a.m. and Bldg. 4203 at 8:30 a.m. Buses should return around 10:45 a.m.

The bus tour schedule is:

- Sept. 28:** Bus A — Habitat for Humanity and Harris Home
Bus B — Harris Home and Habitat for Humanity
- Sept. 30:** Bus A — Habitat for Humanity and Harris Home
Bus B — Harris Home and Habitat for Humanity
- Oct. 5:** Bus A — Red Cross/Volunteer Center and the Opportunity Center of Madison County
Bus B — Christmas Charities and Chi-Ho
- Oct. 6:** Bus A — Harris Home and Children's Hospital
Bus B — Children's Hospital and Harris Home
- Oct. 7:** Bus A — Red Cross/Volunteer Center and the Opportunity Center of Madison County
Bus B — Christmas Charities and Children's Hospital

For more information, call Dennis Gallagher at 544-7587.

Upcoming Events

Community Service Day — The fifth annual Marshall Center Community Service Day, part of the Combined Federal Campaign (CFC), will be Sept. 25. Employees are encouraged to observe the day by volunteering time and special skills to local non-profit agencies. Projects are scheduled with the following agencies: Technology Assistance for Special Consumers, Care Assurance for the Aging and Homebound, Christmas Charities, Habitat for Humanity and the Salvation Army. For information or to volunteer, call Rachel Kamenetzky at 544-1089.

Security Campaign Presentation — Mark Borsi, director of the NASA Security Management Office, will visit Marshall Friday from 9-11 a.m. in Morris Auditorium. He will discuss personnel and physical security, threats against NASA and plans to ensure effective countermeasures. Lee Holcomb, NASA chief information officer, will discuss information technology security. The briefing is open to Marshall civil service and contractor supervisors and managers, program and project managers, and anyone who deals with or is interested in physical, personnel or information technology security implementations. For more information, call Steve Jones at 544-4373.

New Early Out Authority Approved — The Office of Personnel Management has approved a new early out authority that extends the early out period through Sept. 30, 2000. For more information, call Edwina Bressette at 544-8115.

NASA selects 103 innovative small business projects

In an attempt to stimulate the development of new technologies, NASA has selected 103 research proposals for negotiation of Phase II contract awards for its Small Business Innovation Research Program

The selected projects have a total value of approximately \$62 million and will be conducted by 90 small, high-technology firms in 27 states.

In addition to stimulating innovation, the program aims to increase the number of small businesses, including women-owned and disadvantaged firms, conducting federal research and commercializing the results of federally funded research.

Small business contractors submitted 319 proposals. NASA evaluated the proposals to determine whether they successfully met Phase I objectives and represented feasible research innovations that could meet agency needs.

Phase II continues development of the most promising Phase I projects. Selection criteria included technical merit, innovation, value to NASA, commercial potential and company capabilities. Funding for Phase II contracts may amount to \$600,000 for over two years.

The NASA Small Business Innovation Research Program Management Office is located at Goddard Space Flight Center, Greenbelt, Md., with executive oversight by NASA's Office of Aero-Space Technology in Washington, D.C.

Individual projects are managed by NASA's 10 field centers. A listing of the selected companies can be obtained on the Internet at: <http://sbir/nasa.gov>

X-33

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pre-takeoff, takeoff, ascent, return and landing conditions.

"These are the largest composite cryogenic tanks ever built," said Cleon Lacefield, Lockheed Martin Skunk Works vice president for X-33/VentureStar.

"Not only will they hold the super-cold liquid hydrogen, but they also will provide the structural strength of the vehicle and are shaped to conform to the X-33's body. Obviously, designing and assembling these tanks was quite a challenge, and our NASA and industry team did a great job."

"Being able to build key vehicle systems and tanks out of lightweight yet strong composites is an enormous step toward getting us launch vehicles that will support routine and low-cost access

to space," said Gene Austin, Marshall's X-33 program manager. "Short of the flight series, this month's testing of the hydrogen tanks and also our aerospike engines marks the most significant and exciting stage of the X-33 program."

Before testing the tank with liquid hydrogen, it will be partially filled with liquid nitrogen and then pressurized to test its structural integrity. Once nitrogen testing is complete, Marshall engineers will fill the tank with liquid hydrogen to simulate internal pressure loads.

Crews have completed assembly of the X-33's second liquid hydrogen tank. The tank is expected to arrive at Marshall in early October, with testing to begin later this year.

When the Marshall Center tests are complete, the tanks will be shipped to

Lockheed Martin Skunk Works' X-33 assembly facility in Palmdale, Calif., where they will be installed into the vehicle.

Alliant Techsystems in Clearfield, Utah, fabricated the composite components for the tanks. A joint Lockheed Martin-Alliant team assembled the tanks in an enormous autoclave at Lockheed Martin Missiles and Space in Sunnyvale, Calif.

The vehicle is scheduled to conduct flight tests beginning in summer 2000. It will fly faster than 13 times the speed of sound and at an altitude of 60 miles to prove its technologies and systems.

The writer, a contractor employed by ASRI, supports the Media Relations Department.

Getting the full effect

Dr. Craig Kundrot, seated at left, demonstrates the significance of macro-molecular crystal growth research to U.S. Sen. Bill Frist of Tennessee, center, and U.S. Rep. Zack Wamp, also from Tennessee, during a recent visit to the Marshall Center.



Photo by Emmett Given

Propulsion

Continued from page 1

Principal investigators and a description of their proposed work are:

- Glenn Robertson and Ron Litchford of the Marshall Center proposed an experimental study of possible links between superconductors and gravity, as recently discussed in several scientific journals. They plan to use a torsion balance, similar to those used to search for material-dependant gravitational effects, to search for superconductor-gravity effects.

- John Cramer of the University of Washington in Seattle, proposed a test to see if rapidly changing electric fields can affect inertia as suggested in 1991 by James Woodward in the journal *Foundations of Physics Letters*. If there is such an effect, it may be exploited to develop a new method of space propulsion. The research will add to the understanding of how inertia is tied to the surrounding matter of the universe.

- Jordan Maclay of Quantum Fields LLC in Wisconsin, and MEMS Optical Inc. of Huntsville, proposed an experimental and theoretical study of quantum vacuum energy. The experiments will use micro-electromechanical devices to test force and energy effects predicted by quantum electrodynamics.

- Harry Ringermacher of General

Electric Corporate Research and Development in Schenectady, N. Y., with the collaboration of researchers from Washington University in St. Louis, Mo., proposed a magnetic resonance experiment to test a theory linking electromagnetism, mass and time. Ringermacher originally published the theory in 1994 in the journal *Classical and Quantum Gravity*.

- Kevin Malloy of the University of New Mexico in Albuquerque, and Raymond Chiao of Berkeley University in California, proposed experiments and theoretical work on "superluminal quantum tunneling," an effect where light is observed to pass through barriers faster than it travels through normal space. The proposed research will critically examine some of the faster-than-light hypotheses associated with this effect.

- Serguei Krasnikov of Altamonte Springs, Fla., proposed to theoretically assess the necessity of "negative energy" suggested in recent scientific literature on hyperfast travel. The possibilities for enabling hyperfast travel are more feasible if negative energy is not required.

Job Opportunities

SES, MSFC-ES-13-99, Manager, Pathfinder Program, Space Transportation Directorate. Closes Sept. 24.

CPP 99-107-CL, AST, Technical Management, GS-801-14, Engineering Directorate, Materials, Processes and Manufacturing Department. Closes Sept. 20.

CPP 99-113-CV, AST, Flight Activity Planning, GS-801-14, Flight Projects Directorate, Payload Operations and Integration Department, Payload Systems Group. Closes Sept. 14.

CPP 99-114-JB, AST, Technical Management, GS-801-14, Center Operations Directorate, Logistics Services Department, Transportation & Logistics Engineering Group. Closes Sept. 14.

CPP 99-116-JB, Security Specialist, GS-080-7, Center Operations Directorate, Protective Services Department. Closes Sept. 20.

Obituaries

Couch, J.D., 80, Union Grove, died Aug. 17. He retired from Marshall in 1987 where he worked as a materials expeditor in the Test Lab. He is survived by his wife, Willie J. Couch.

Fulmer, Alfred H., 67, Huntsville, died Aug. 23. He retired from Marshall in 1986 where he worked as an aerospace engineering technician in the Structures and Propulsion Laboratory. He is survived by his wife, Valera P. Fulmer.

Employee Ads

Miscellaneous

- ★ Over 100 golf clubs: irons, metal woods, wood woods, putters, 10 golf bags. 883-5114
- ★ Auburn/Idaho football tickets, two tickets, game day Sept. 11, \$25 for pair. 722-9114
- ★ Performa 631CD with ethernet and monitor, \$125; Apple keyboard and keyboard II, \$10. 885-0789
- ★ Murray riding lawn mower, 38", new battery, seals, cab, muffler, etc., make offer. 828-6213
- ★ In-wall ironing board set and oversized garden tub, \$45 each. 895-2959
- ★ Sewing machine, Viking I w/manuals & carrying case, \$1,650 obo; wedding dress, straight w/ detachable train, white, size 10, \$100. 351-7804
- ★ Playpen, \$35; baby swing, \$20; changing table, \$25; fold-up play tunnels/cubes, \$35. 776-9165
- ★ Weslo Cardioglide exercise rider, \$37.50; Goldwin XLS driver, 10-degree loft, firm graphite shaft, \$50. 971-9710
- ★ Dry firewood, oak/hickory, you haul, \$40/load; delivered, \$90/load. 852-4602
- ★ Wooden daybed and mattress \$65; Philco console TV, cable ready, \$70. 498-3680
- ★ One hamster, two gerbils, cages, accessories & supplies available, 1/2 original cost. 828-3887
- ★ Alabama/Houston football tickets, Legion Field, great seats, \$26 each. 536-5132
- ★ 1993 Muskin Pool, 30' x 15', w/DE filter & pump, new ladder, very good condition, \$800 obo. 729-1175
- ★ Color television, 20", J.C. Penney brand, \$30. 895-9520/Philip
- ★ Alabama/Louisiana Tech football tickets, game day Sept. 18, Birmingham, 4 p.m., \$26 each. 534-9524
- ★ Wolff 16S tanning bed, 110V. 882-1723

Vehicles

- ★ 1998 Jeep Cherokee Laredo, V6, slate, 30K miles, 4-door, CD/cassette, all power, take over payments. 881-3800
- ★ 1997 Honda Civic hatchback, automatic, a/c, 25K miles, black w/gray interior, \$10,200. 882-1566
- ★ 1994 Nissan, Sentra-XE, 90K miles, white, auto, air bag, a/c, cassette, cruise, \$4,500 obo. 772-9930
- ★ 1992 Buick Roadmaster Limited, 124K miles, excellent condition, \$7,500 obo. 852-4602
- ★ 1993 Ford Aerostar van, 53K miles, blue, a/c, AM/FM cassette, cruise, excellent condition,

- \$5,800. 852-5900
- ★ 1998 Toyota Tacoma SR5 extended cab, tan, 13K miles, 4-cylinder, 5-speed, AM/FM cassette, must sell. 461-6337
- ★ 1989 Oldsmobile Cutlass Supreme, automatic, red, 130K miles, needs transmission & other work, \$800 obo. 430-2796
- ★ 1993 Ford Taurus GL, automatic, all power, new transmission, \$4,375. 880-7204
- ★ 1984 Ford Bronco II, 4x4, V-6, automatic, a/c, PS/PB, AM/FM cassette, new tires & brakes, 98K miles, \$5,000. 723-4991
- ★ 1997 Mitsubishi Galant ES, 4-door, power windows/locks, keyless entry, a/c, CD, cruise, \$12,050. 859-6574
- ★ 1992 Acura Integra, red, 2-door hatchback, spoiler, 5-speed, sunroof, a/c, am/fm stereo cassette, cruise, \$6,400. 764-2492

Free

- ★ Calico cat, spayed, all shots, nice cat for elderly person. 885-1771

Wanted

- ★ Office desk w/drawers, roll-top preferred. 881-5088
- ★ Improved cylinder barrel for Browning shotgun, 16 gauge. 883-7851
- ★ Used piano. 233-4104

Found

- ★ Watch, found in parking lot of Bldg. 4200. Call 544-4758 to identify
- ★ Walkman radio cassette player & child's sunglasses, found at Bldg. 4202, the day of Apollo 11 30th Anniversary Celebration. Call 544-4758 to identify
- ★ Silver brooch, found at Bldg. 4200. Call 544-0030 to identify

Center Announcements

- ☛ **Government Accountants Meet** — The North Alabama Chapter of the Association of Government Accountants will hold its monthly meeting Sept. 16 at the Marriott at the U.S. Space & Rocket Center. The meeting begins with social time at 5:30 p.m., dinner at 6:15 p.m., and speaker at 7 p.m. The cost is \$12 per person. For reservations, call Sandra Seymour at 544-0099.

- ☛ **Facilities Office Breakfast** — Facilities Office employees, retirees and friends will meet Sept. 14 at 8 a.m. for breakfast at Shoney's on University Drive and Memorial Parkway. For more information, call Carl Gates at 232-2695.
- ☛ **NASA/MSFC Retirees Association** — The NASA/Marshall Retirees Association will meet at the Valley Hill Country Club Sept. 16 at 6:30 p.m. Bob Ryan will discuss Marshall mentorship activities. Cost for dinner is \$16; advance reservations are required. For more information or to make reservations, call Ellery May at 881-2553 or Ed Buckbee at 881-9622.
- ☛ **TFAWS '99 Workshop** — The Tenth Thermal & Fluids Analysis Workshop (TFAWS '99) will be held Sept. 13-17, at the Bevill Center in Huntsville. Marshall is hosting the event. The workshop will focus on applications of thermal and fluids analysis in the aerospace field. The workshop will bring industry, academia and government together to share information and exchange ideas about applications analysis tools and methods. To register, visit the Web at: <http://tfaws99.msfc.nasa.gov>
- ☛ **NASA Men's Bowling League** — The NASA Men's Bowling League is under way at Monarch Lanes on Bob Wallace Avenue. All NASA employees, dependents and on-site contractor personnel are eligible to participate. For more information, call Chuck Seal at 544-1120 or Rob Lake at 544-1176.
- ☛ **MARS Ballroom Dance Club** — The MARS Ballroom Dance Club will offer tango and waltz lessons on Sept. 13, 20, 27 and Oct. 4 in the Parish Hall of St. Stephen's Episcopal Church at 8020 Whitesburg Drive. Intermediate classes will start at 7 p.m. and beginner classes at 8. The lessons will be taught by Joe Whorley and are available to the public for \$4 per person per night. Whorley is a certified instructor by both Arthur Murray and Fred Astaire. For more information, call Linda Kinney at 544-0563.
- ☛ **Rocket City Rowing Club** — The Rocket City Rowing Club is offering a rowing clinic for adult beginners on Saturday, Sept. 11, 18, 13 and Oct. 2, from 10 a.m.-noon. The clinic teaches basic rowing technique, along with equipment and basic lingo. Cost is \$60. To sign up, call Halley Little at (256) 539-8841.
- ☛ **Redstone Toastmasters** — Join Redstone Toastmasters weekly at 6 p.m. on Tuesday at Piccadilly Cafeteria in Madison Square Mall. For more information, call 461-0476.
- ☛ **Lunar Nooners Toastmasters** — The NASA Lunar Nooners Toastmasters Club meets Tuesday at 11:30 a.m. in Bldg. 4610 cafeteria conference room. For more information, call 544-5142.

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